

Genus *Ensete* (Musaceae) in India

Alfred Joe, PE Sreejith and M Sabu*

Department of Botany, University of Calicut, Calicut University P.O., Kerala, India 673 635

*Author for correspondence: msabu9@gmail.com

Abstract

A detailed account of the genus *Ensete* (Musaceae) in India is presented, including a key to the two species known from the country. Updated descriptions and colour photographs of each species are provided, with notes on the phenology, ecology, distribution, cytology, morphological variation and uses. We also provide a brief history of the genus and descriptions of the two species present in India. *Ensete lecongkietii* is treated here as a synonym of *E. superbum*.

Introduction

Ensete is a unique genus characterized by its non-stoloniferous habit, chromosome count of $n = 9$, and its inability to be propagated in any way other than via seed. The name *Ensete* was first used by Bruce (1862) who described and illustrated a plant from Abyssinia under its native name *Ensete*. The name was originally used by Gmelin (1791) as a specific epithet in the Linnaean genus *Musa* in the 13th edition of *Systema Naturae*. Horaninow (1862) noted its marked difference from *Musa*, and treated it as a separate genus, renaming *M. ensete* as *Ensete edule*, but failed to treat some species that shared the characters of his genus. In subsequent treatments the genus *Musa* has been surveyed by Sagot (1887a, b), Baker (1893), Schumann (1900) and many other botanists who failed to adopt Horaninow's generic classification. Baker (*l.c.*) followed by Schumann (*l.c.*) treated Gmelin's species under the subgenus *Physocaulis* of *Musa*. The genus *Ensete* was in obscurity until the work of Cheesman (1947), who resurrected the genus based on genetic, cytological, and taxonomic data, while establishing a banana breeding program. Cheesman resolved problems created by earlier taxonomists by transferring twenty five species of *Musa* into *Ensete*; this included the whole subgenus *Physocaulis* of Baker. Cheesman pointed out that these taxa differed from *Musa* in being a group of single stemmed monocarpic herbs with the haploid chromosome number of 9, pseudostems dilated at the base, relatively fewer fruits with larger seeds that are irregularly globose and smooth. Baker and Simmonds (1953) revised the genus in Africa and placed most of the species treated by Cheesman (1947) in synonymy. However, they wrongly made *E. ventricosum* a synonym of *E. edule*, which was subsequently corrected by Simmonds (1953) since *E. ventricosum* was the older name. The basionym of *E. ventricosum*, *Musa ventricosa* Welw., predates *E. edule*. In the protologue of the genus, Horaninow included only *E. edule*, and for this reason it remained the obligate type species.

Simmonds (1960) listed six species under the genus, whereas Kress (1990) listed seven. Väre and Häkkinen (2011) provided a checklist of *Ensete* with nomenclatural notes and recognized eight species and one variety. Of the eight species, *E. agharkarii* (Chakravorti) Hore et al., is treated as a synonym in this work. *Ensete lecongkietii* Luu et al., was published after the checklist of Väre and Häkkinen (2011), and was diagnosed based

on the difference in size, and number of anthers in the male flower. *Ensete lecongkietii* is here determined to be a synonym of *E. superbum*, and therefore we consider *Ensete* to contain seven species, with a distribution primarily in Africa and Asia.

Of the two species recorded for India, *E. glaucum* has a restricted distribution in the north-eastern states, while *E. superbum* is mainly restricted to Peninsular India (Joe 2015). There are also reports of *E. ventricosum* in cultivation at Kodaikanal, in the Palni Hills of southern India (Matthew 1969, 1996, 1999). Even though Matthew (1969) included *E. edule* in ‘The Exotic Flora of Kodaikanal, Palni Hills’ as an introduced garden plant, we could find only a few plants cultivated in home gardens and therefore in the current study we do not consider it an introduced plant.

Taxonomy

Ensete Bruce ex Horan., Prodr. Monogr. Scitam. 40. 1862.

Type: *Ensete edule* Bruce ex. Horan., Prodr. Scitam. 40. 1862.

Distribution: *Ensete* occurs primarily on the African continent, but is also known from India, southern China, Thailand, Myanmar, Philippines, Indonesia, and New Guinea.

Ecology: The majority of species grow in open, moist habitats, along rivers and swamps, and in forest clearings. Also common in grasslands or in rock crevices, and in forest shades or margins.

Cytology: $2n = 18$ (White 1928, Cheesman and Larter 1935, Agharkar and Bhaduri 1935, Chakravorti 1948).

Pollination vectors: Insects, birds and bats (Majumdar et al. 2013).

Uses: The type species, *E. edule* (= *E. ventricosum*), is a staple food crop in parts of southern Ethiopia. Edible starch is extracted from the corm and pseudostem and fermented to make ‘kocho’, an important food for several million people in the region (Demeke 1986, Sharrock 1997). In northern Uganda flower buds and seeds are cooked and eaten, while seeds are used as decorative beads (Mabberley 2005). With its large conical pseudostem *Ensete edule* has a high aesthetic value and is used as a garden ornamental.

Morphological variation: The size and shape of vegetative and reproductive parts varies depending on soil type, availability of water, and climatic conditions. The basal flowers are either female or bisexual. The number of stamens varies with the sixth rudiment staminode sometimes developing into a complete fertile stamen. Fruit size is dependent on pollination and fertilization.

Key to *Ensete* species in India

1. Pseudostem circumference to c. 2 m at base; outer leaf sheaths green, not dry; leaves arranged in a terminal tuft at the apex of pseudostem *E. glaucum*
1. Pseudostem circumference to c. 1.5 m at base; outer leaf sheaths fully dry giving the trunk a dry brown appearance; leaves not tufted, well-spaced from c. middle of pseudostem to the apex *E. superbum*

1. ***Ensete glaucum*** (Roxb.) Cheesman, Kew Bull. 2(2): 101. 1947

Musa glauca Roxb., Hort. Bengal. 19. 1814. *nom. nud.*, Pl. Coromandel 3: 96, t. 300. 1819. *descr.*, Fl. Ind., ed. Carey & Wall. 2: 490. 1824.

Type: Roxb., Pl. Coromandel 3: t. 300. 1819 (Lectotype, designated by Argent 1976).

Ensete calospermum (F. Muell.) Cheesman, Kew Bull. 2(2): 102. 1947.

Musa calosperma F. Muell. ex Mikl.-Maclay, Proc. Linn. Soc. New South Wales 10: 348. 1885.

Type: Papua New Guinea: Northern New Guinea, Moresby [Basilaki] Island, N. Miklouho-Maclay s.n. (MEL 588768, lectotype designated by Häkkinen & Väre 2008).

Ensete agharkarii (Chakravorti) Hore, Baldev D. Sharma & G. Pandey, J. Econ. Taxon. Bot. 16(2): 450. 1992.

Musa agharkarii Chakravorti, J. Indian Bot. Soc. 27: 93. 1948.

Type: Chakravorti, Journ. Ind. Bot. Soc. 27: pl. 1, figs 1–5. 1948 (Lectotype designated by Väre & Häkkinen 2011).

Musa nepalensis Wall., in Roxb., Fl. Ind., ed. Carey & Wall., 2: 492. 1824.

Monocarpic non-stoloniferous herbs, plants not suckering. *Pseudostem* conical with distinctly swollen base, elongated, mature pseudostems 1.5–5 m tall, stout, 0.8–1.5 m circumference at the base, with loosely packed outer leaf sheaths that are not dry, green in colour, glaucous, more glaucous towards apex region, prominent at young stages, sap orange coloured. *Leaf* habit erect to intermediate or drooping, leaves arranged as a terminal tuft at apex of pseudostem, laminae 150–210 × 40–60 cm, oblanceolate, apex acute, adaxially green, dull, abaxially medium green, glabrous, leaf bases symmetric, both sides pointed, midrib adaxially green, abaxially yellowish green. *Petiole* 35–65 cm long, green or yellow-green, glaucous, margins open and spreading, without any blotches at base, bases winged, smooth, loosely or not clasping the pseudostem. *Inflorescence* pendulous, peduncle 35–90 cm long, green, glaucous, arched. Sterile bracts 5–7, ovate to rotund, persistent and greenish till the maturity of fruits, 25–40 × 14–19 cm, adaxially light green, glaucous, abaxially green, glaucous. Female bud lanceolate, imbricate. Female bracts ovate to rotund, 25–36 × 12–24 cm, adaxially and abaxially green, glaucous, apex cuspidate, lifting 1–2 bracts at a time, just open, persistent, greenish till fruits ripe, basal 5–14 bunches female or variably bisexual. *Bracts* and flowers integral with each other and with axis. *Flowers* 13–22 per bract in two rows, 6.8–7.5 cm long. Compound tepal 3–3.3 × 0.6–0.7 cm, creamy, lobes 5, divided nearly to the base, outer three lobes much longer and broader, 2.3–2.4 cm long, inner two lobes, linear, 1.9–2.1 cm long. Free tepal with two lateral sub-orbicular lobes (wing-like) and a narrow elongated central lobe (acumen), 1.5–1.6 × 1.2–1.3 cm, translucent cream or white, acumen 0.8–1 cm long. *Stamens* 0–5, 3–3.5 cm long, filaments 1.9–2.1 cm long, cream, anthers golden yellow, 1.5–1.8 cm long. *Staminodes* 4–5 with a much small rudiment sixth staminode, 1.2–1.9 cm long, cream. *Ovary* 3.8–4.2 cm long, straight, cream or creamy-green with purple patches, glaucous, with ovules in two rows per locule, style 2.5–2.8 cm long, straight, inserted, cream, stigma globose, cream, sticky. Male bud lanceolate, imbricate, rachis falling vertically, green, glabrous. Male bracts ovate to rotund or lanceolate, 20–29 × 11–15 cm, adaxially and abaxially green, glaucous, apex cuspidate, lifting 1–2 bracts at a time, just open, persistent, greenish till the maturity of fruits or dry, male bud continues to grow even after the ripening of the fruits. Bracts and flowers integral with each other and with axis. Male flowers 18–22 per bract in two rows, 5.9–6.2 cm long. Compound tepal 3.6–3.9 cm long, creamy, lobes 5, divided nearly to the base, outer lobes much longer and broader, 2.3–2.4 cm long, inner lobes 1.9–2.1 cm long. Free tepal with two lateral sub-orbicular lobes (wing-like) and a narrow elongated central lobe (acumen), 1.3–1.5 × 1.8–2.1 cm, creamy translucent. *Stamens* 5–7, 3.2–3.8 cm long, filaments white, exerted, 1.9–2.4 cm long, anther cream, 1.2–1.7 cm long, curved backwards. *Pollen* grains with regularly warty surface, cream. *Ovary* rudiment, straight, 2.2–2.6 cm long, creamy-white or creamy, style much reduced, cream, stigma not developed. Fruit bunch compact, with 5–14 hands and 13–22 fruits per hand, in two rows, fingers almost perpendicular to the axis. *Fruits* straight, 7.4–8.2 cm long, slightly ridged, apex blunt tipped or acuminate in less fertilized fruits, with floral relicts, pedicel absent, pericarp green, slightly glaucous, yellow when ripen, pulp cream. *Seeds* many, variable according to the fertilization, 7–21 per fruit, 1–1.3 × 0.8–1.2 cm, round or irregularly round, black except hilum region, surface smooth. **Figs 1, 2, 6A–H.**

Flowering and Fruiting: Flowers mainly during the rainy season (May–August). Male buds continue growth after fruit maturation, and until at least March.

Distribution: China, India, Indonesia, Laos, Myanmar, Philippines, Papua New Guinea, and Thailand. In India it is found in Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland and Tripura. In various parts of India it is also cultivated in home gardens as an ornamental.

Ecology and habitat: *Ensete glaucum* is commonly found in open places near dry deciduous forest margins and grasslands. It occasionally grows near small streams and on river banks, and in moist soil, sometimes co-occurring with *Musa balbisiana* and *M. thomsonii*. During the dry season plants will be in a dormant state without any leaves. Flowering occurs within one or two years post germination if water and nutrients are sufficient, and may take over five years under less fertile conditions.

Etymology: The specific epithet refers to the glaucous pseudostem.

Cytology: 2n = 18 (Agharkar and Bhaduri 1935; Cheesman and Larter 1935; Chakravorti 1948).

Pollination vectors: Insects, birds and bats (Majumdar et al. 2013).

Uses: Due to its conical stem and mostly persistent green bracts, *E. glaucum* has ornamental potential. The Mizo people of north-eastern India once prepared different dishes with the buds and sheaths. The pseudostem is used as a vegetable in Meghalaya (Rao and Hajra 1976), while the orange sap from the pseudostem has known medicinal properties (Uma 2006).

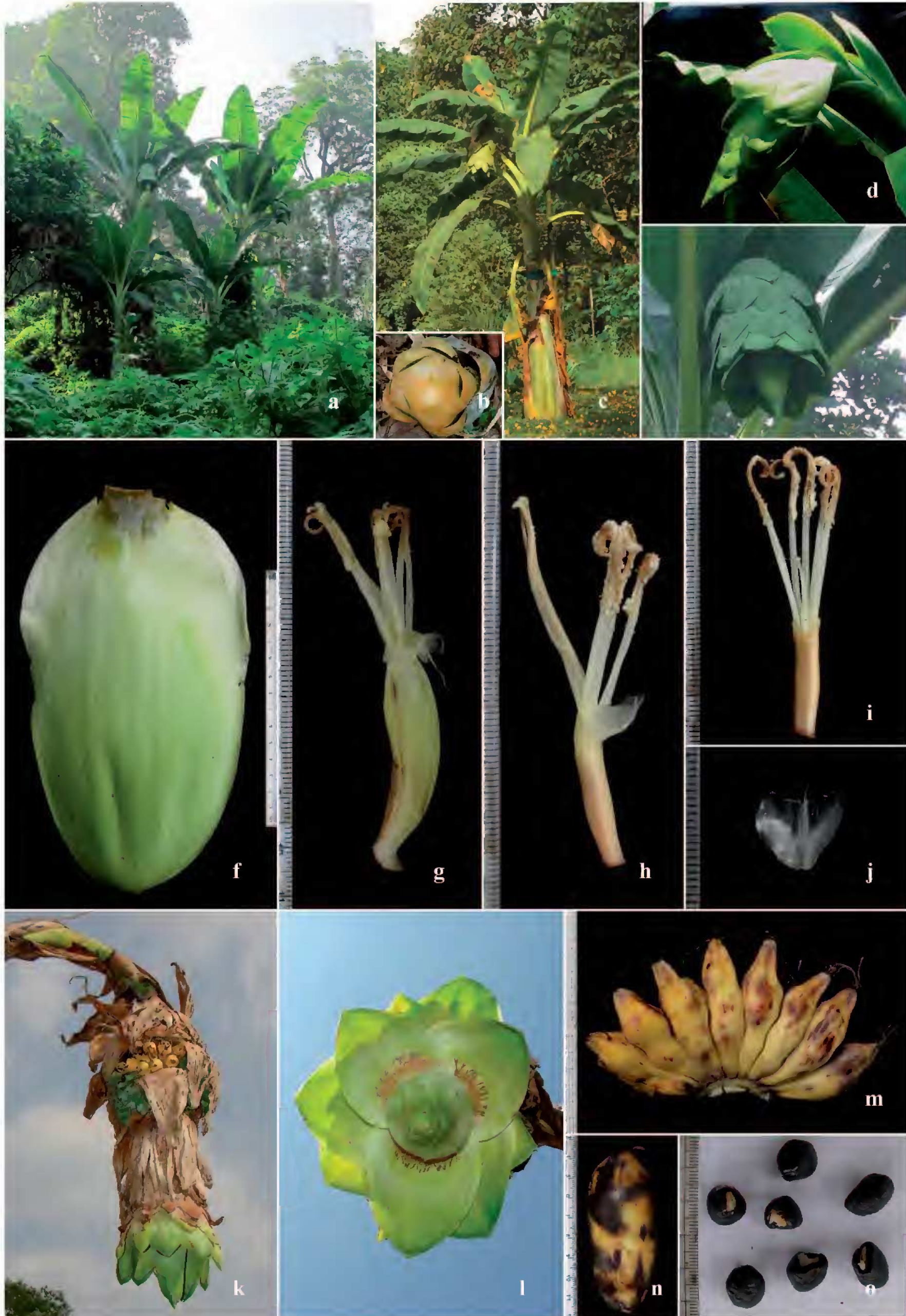


Fig. 1. *Ensete glaucum*. **a**, habitat; **b**, cross section of pseudostem showing orange sap; **c**, habit; **d–e**, inflorescences at early stages; **f**, bract; **g**, female flower; **h–j**, male flower parts; **h**, entire flower; **i**, flower without tepals; **j**, free tepal; **k**, inflorescence with advanced stages of male bud; **l**, male bud; **m**, fruit bunch (produced from non-fully fertilized ovaries); **n**, single fruit produced from fully fertilized ovary; **o**, seeds. Photos by Alfred Joe (**a** from A. Joe & Ashfak 121773; **b–o** from A. Joe & M. Sabu 130897).

Morphological variation: The plant shows much variation in size depending upon the climatic and soil conditions and availability of water. The basal flowers are female with five staminodes and one much reduced rudiment staminode, but hermaphrodites with 2–5 fertile stamens and staminodes also occur. The male bud continues growth in some plants, even after the ripening of fruits, but sometimes degenerate before fruits mature. Fruits are uneven in size or undeveloped when the flowers are partially fertilized. In such cases, fruits have an acuminate apex and a lower number of seeds, while the fruits filled with seeds are almost rounded at the apex.

Notes: *Musa glauca* was first listed in Roxburgh's *Hortus Bengalensis* (Roxburgh 1814) and the detailed description appeared in *Plants of the Coast of Coromandel* (Roxburgh 1819). Subsequently, Roxburgh included the species in his *Flora Indica* (Roxburgh 1824). Horaninow (1862) followed Roxburgh and failed to place *M. glauca* under *Ensete* in spite of its close resemblance to the latter. Subsequently, Baker (1893) placed *M. glauca* in his subgenus *Eumusa* [= *Musa*], though all characters agreed with the subgenus *Physocaulis* and he himself admitted that it "has flowers like *M. superba*". Sagot (1887a), who divided the genus *Musa* into different groups, and from whom Baker formalized his subgeneric classification, included it correctly under 'Bananiers Géants' (Giant Bananas), but subsequent authors followed Baker. Cheesman (1947), who revived the genus *Ensete*, treated this species under it. Argent (1976) designated the icon of *M. glauca* in '*Plants of the Coast of Coromandel*' as lectotype. He also synonymised *E. calospermum* (F.Muell.) Cheesman under *E. glaucum*.

The status of *M. nepalensis* Wall., has been in a state of flux for a long time. Wallich described the plant from Nepal in Roxburgh's (1824) *Flora Indica*. According to Baker (1893), Wallich described the species principally from "two large unpublished drawings by Wallich, now at Kew". Anonymous (1894) included a letter by Dr. King, dated Calcutta, 22nd August 1893, which said: "I do not believe in the existence of the species which Wallich called *M. nepalensis*. I have never been able to hear of, or find, any specimens of a big non-stoloniferous plantain on the lower slopes of the Himalaya. I have made inquiries in Nepal where Wallich says it grows. Wallich must have described Roxburgh's *M. glauca* under the name *M. nepalensis*". Simmonds (1960) also supported King's view mentioned above. The existence of the taxon has also been questioned by Cheesman (1947), Moore (1957), Väre and Häkkinen (2011), but no one has confirmed its identity. Väre and Häkkinen (2011) considered the name to be illegitimate because Wallich himself thought it was either doubtfully distinct from *M. superba* or intermediate between that species and *M. glauca*. However, expressions of doubt do not invalidate names. In the course of this study, we could not find any specimen or illustration of *M. nepalensis* at K or CAL and agree with Simmonds (1960) that *M. nepalensis* and *E. glaucum* should be considered conspecific.

Musa agharkarii was described by Chakravorti (1948) who placed it in the subgenus *Physocaulis* of Baker. He distinguished it from the other species in Asia based on its geographic distribution. He was well aware of *M. glauca* but he neglected the icon of Roxburgh, which shows the inflorescence at advanced blooming, whereas *M. agharkarii* was described in its female stage, or during early development of the inflorescence, which can be confusing to those who are unfamiliar with the early flowering stages of *E. glaucum*. Some workers treated *M. agharkarii* as a synonym of the latter (Rao and Hajra 1976, Majumdar et al. 2013) but this was overlooked by Hore et al. (1992) who made a new combination for it under *Ensete*. Väre and Häkkinen (2011) followed Hore et al. (1992) and lectotypified the species using Chakravorti's plate. From our study we are convinced that these taxa are conspecific and treat *E. agharkarii* as a synonym of *E. glaucum*.

The existence of *E. glaucum* in India was reported by Simmonds (1960) and Rao and Hajra (1976) from Meghalaya. Giri et al. (2009) confirmed its presence from Arunachal Pradesh. Uma et al. (2005) mentioned its widespread distribution in many districts of Mizoram and in some parts of Assam nearer to Mizoram, both wild and domesticated. Recently, Majumdar et al. (2013) recorded its occurrence from Tripura. The present study has extended the known distribution of this species to Manipur and Nagaland and concluded that, in India, wild populations of *E. glaucum* are restricted to the north-eastern region, although plants are also found in home gardens throughout India as ornamentals. Rao and Kumari (1967, 2008) recorded the natural occurrence of *E. glaucum* from Andhra Pradesh in Eastern Ghats of India, but these occurrences are of *E. superbum*, which is commonly found in Peninsular India; this has been confirmed from specimens held at the Madras Herbarium.

IUCN Status: Based on intensive field surveys during the past several years, it is estimated that *E. glaucum* in India comes under the Critically Endangered (CR A2 a,c,d) criteria of IUCN (IUCN 2011). The populations are restricted to some pockets of natural vegetation, and continuous destruction of the habitat for Jhum (slash-and-burn) cultivation may adversely affect existing populations.

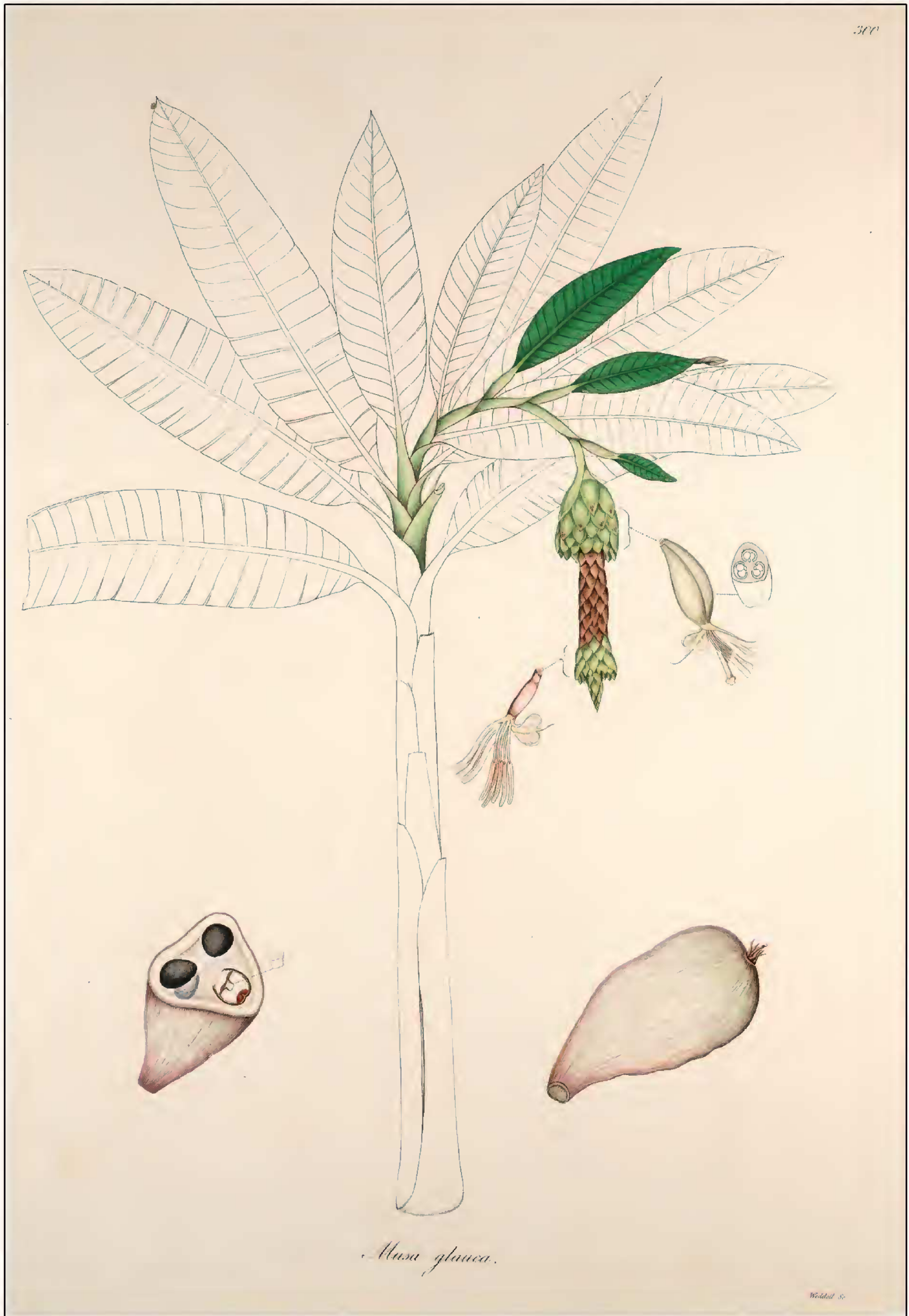


Fig. 2. Lectotype of *Ensete glaucum* (Roxb., Pl. Coromandel 3: t. 300. 1819).

Additional specimens examined: INDIA: KERALA: Malappuram Dist., Calicut University Botanical Garden (Cultivated), 25 Jan 2014, A. Joe & M. Sabu 130897 (CALI). MANIPUR: Ukul Dist., on the way to Kamjong, Nungou Village, N24°27.916' E094°23.750', 1189 m alt., 07 Dec 2012, A. Joe & Ashfak 121640 (CALI). MEGHALAYA: Khasi Hills, Umdihar, 5 miles from Nongpoh, 20 Jun 1973, P.K. Hajra 45683 (ASSAM, CALI); Khasi Hills, Umdihar, 5 miles south of Nongpoh, 30 Jun 1973, A.S. Rao 45684 (ASSAM); Khasi Hills, Barnihat Citrus Research Station, 31 Jul 1973, P.K. Hajra 45685 (ASSAM); West Garo Hills, Tura Peak, N25°30.494' E090°13.723', 471 m alt., 27 May 2013, A. Joe & Ashfak 121773 (CALI). MIZORAM: Lengpui, Modal, near Zero Point, N23°49.740' E092°37.989', 277 m alt., 15 Mar 2012, A. Joe & Sreejith 130817 (CALI); Champai Dist., Zote, 5 kms from New Champai, N23°28.579' E093°20.867', 1261 m alt., 16 May 2013, A. Joe & Ashfak 121730 (CALI). NAGALAND: Tuensang Dist., near Noklak town, Noklak, 01 Dec 2012, A. Joe & Ashfak 121628 (CALI).

2. *Ensete superbum* (Roxb.) Cheesman, Kew Bull. 2(2): 100. 1947

Musa superba Roxb., Hort. Bengal. 19. 1814, *nom. nud.*, Pl. Coromandel 3: 17, t. 223. 1819, *descr.*, Fl. Ind., ed. Carey & Wall., 2: 489. 1824

Type: East India, Roxburgh *s.n.* (K [barcode K000309030] image!), lectotype designated by Väre and Häkkinen 2011).

Ensete lecongkietii Luu, N.L. Vu & Q.D. Nguyen, Folia Malaysiana 13(2): 44. 2012. *syn. nov.*

Type: VIETNAM, Binh Thuan Province: Ham Thuan Nam District, Thuan Nam Township, Nhan Hill, 48P815678.37m & E1200329.68 m., 5 June 2012, Luu 872 (Holotype: VNM); Luu 873 (Paratype: VNM).

Ensete glaucum auct. non. (Roxb.) Cheesman, Subba Rao & Kumari, Fl. Visakhapatnam Distr. (Andhra Pradesh) 2: 266. 2008.

Vernacular Names: Malayalam: Kalluvazha, Malavazha; Tamil: Kalluvazhai; Kannada: Kallu bale, Kalbale; English: Cliff banana, rock banana.

Monocarpic non-stoloniferous herbs, plants not suckering, suckers produced when the pseudostem cut from the base. *Pseudostem* conical with distinctly swollen base, congested, with tightly packed outer leaf sheaths that are full dry giving trunk dry appearance, mature pseudostems 1–4 m tall, stout, 0.6–2 m circumference at the base, green only towards apex, glaucous, more glaucous towards apex region, prominent at young stages, sap orange coloured. Leaf habit erect to intermediate or drooping, leaves spatially arranged from middle to apex of pseudostem, laminae 90–320 × 28–58 cm, oblanceolate, apex acute, adaxially green, dull, abaxially green, glabrous, leaf bases symmetric, both sides pointed, midrib adaxially green or purple, abaxially yellowish-green. *Petiole* 15–42 cm long, upper half green, lower half yellow-green with black dots, slightly glaucous, margins open with spreading, with black blotches at base, bases winged with smooth margins and clasping the pseudostem. *Inflorescence* pendulous or sub-horizontal, peduncle 30–60 cm long, green or green with black patches, glabrous, arched. Sterile bracts 4–7, ovate to rotund, persistent and dry before the maturity of fruits, 15–28 × 5–15 cm, adaxially light green or pink-purple or dark brown-purple, highly glaucous, abaxially pink-purple, glaucous. Female bud lanceolate, imbricate. Female bracts ovate, 14–25 × 5–16 cm, adaxially greenish or pink-purple or brown-purple, glaucous, pink-purple or brown-purple abaxially, glaucous, apex round, lifting 1–2 bracts at a time, open and reflexed, not revolute, persistent, dry before fruits mature, basal 3–14 bunches female or variably bisexual. *Bracts* and flowers integral with each other and with axis. *Flowers* 6–15 per bract in two rows, 7–10.2 cm long. Compound tepal 2.9–3.6 × 0.7–1.1 cm, creamy, divided nearly to the base, lobes five, outer three lobes much longer and broader, 2.3–2.4 cm long, inner two lobes linear, 1.9–2.1 cm long. Free tepal with two lateral sub-orbicular lobes (wing-like) and a narrow elongated central lobe (acumen), 0.9–1.8 × 1.2–1.4 cm, translucent cream or white, acumen 0.5–1 cm long. *Stamens* 0–5, 3–3.8 cm long, filaments cream, anthers creamy yellow. *Staminodes* 4–5 with a much smaller rudimentary sixth staminode, 0.7–1.7 cm long, cream to creamy orange. *Ovary* 4.5–6.9 cm long, straight, grayish green or dull brownish green, glaucous, with ovules in 2 rows per locule, style 2.3–2.7 cm long, straight or slightly curved, inserted, cream or creamy orange with pink-purple patches towards base, stigma globose, cream, sticky. Male bud lanceolate, in advanced blooming ovoid to top-shaped or lanceolate, imbricate, rachis falling vertically, brown, glaucous. Male bracts ovate to rotund or lanceolate, 15–23 × 12–15 cm, adaxially greenish or pink-purple or brown-purple towards apex, highly glaucous, abaxially red-purple or brown purple, glaucous, apex rotund, not revolute, lifting 1–2 bracts at a time, just open, deciduous, sometimes persistent near male bud at advanced blooming, male bud continues to grow even after ripening of the fruits. *Bracts* and flowers integral with each other and with axis. Male flowers 12–28 per bract in two rows, 5.9–7.8 cm long. Compound tepal 3.8–4.7 cm long, creamy, divided nearly to the base, lobes five, outer three lobes much longer and broader, inner two lobes linear, sometimes absent. Free tepal 0.8–1.3 × 0.8–1.2 cm, with two lateral sub-orbicular lobes (wing-like) and a narrow elongated central lobe (acumen), creamy translucent. *Stamens* 3–6, 3.5–4.1 cm long, exerted, filaments cream, 4–4.4 cm long, anther creamy white with cream pollen, orange-red to purple opposite to thecae, 2.5–3 cm long, curved

backwards, pollen grains with regularly warty surface, cream. *Ovary* rudiment, straight, 2.2–3.5 cm long, creamy white or creamy orange, style much reduced, cream, 1.3–1.7 cm long, stigma not developed. Fruit bunch compact, with 3–14 hands and 6–15 fruits per hand, in two rows, fingers almost perpendicular to the rachis. *Fruits* straight, 5.5–9.5 cm long, slightly ridged, apex slightly pointed, 0.5–1 cm long, with floral relicts, pedicel 0.5–0.8 cm long, pericarp green, slightly glaucous, yellow when ripe, pulp cream. *Seeds* many, 20–90 fruits, variable according to the fertilization, 0.6–1.1 × 0.6–1 cm, round, black except hilum region, surface smooth. **Figs 3, 4, 5, 6 I–S.**



Fig. 3. *Ensete superbum*: **a**, habitat; **b**, habit; **c**, leaf apex; **d**, leaf base; **e**, cross section of petiole; **f–g**, inflorescences at early stages; **h–k**, female flower parts; **h**, entire flower; **i**, compound tepal; **j**, free tepal; **k**, cross section of ovary; **l**, inflorescence with advanced advanced stage of male bud; **m**, bract-adaxial surface; **n**, bract-abaxial surface with male flowers; **o**, male flower; **p**, fruit bunch; **q**, single fruit; **r**, seeds. Photos by Alfred Joe (a–r from A. Joe & M. Sabu 130896).

Flowering and fruiting: Mainly during the rainy season (May–September) and male bud continues to grow and extends to the following year.

Distribution: India, Myanmar, Thailand and Vietnam. In India *Ensete superbum* is mainly distributed throughout Peninsular India and some parts of Gujarat. It is also cultivated as an ornamental throughout India. There are some reports of its occurrence from Myanmar (Kress et al., 2003) and from Thailand (De Langhe et al. 1999) and as it commonly occurs near human populated areas, may have become naturalized from an introduced plant.

Ecology and habitat: Found mostly in rocky areas or in moist soils. Sometimes present in rock crevices and steep rocky cliffs. It is a monocarpic herb that dies after flowering. It takes one to more than six years to flower depending upon the availability of water and nutrients.

Etymology: The specific epithet refers to the superb nature in regards to the stout form of the pseudostem and inflorescence.

Cytology: $2n = 18$ (Agharkar and Bhaduri 1935).

Uses: Reportedly the seeds of *E. superbum* are used for various human ailments such as diabetes, leucorrhoea, kidney stones, dysuria, etc. (Kumar et al. 2010). Seed powder is used to relieve kidney stones and painful urination (Yesodharan and Sujana 2007, Diana and George 2013). As a result, seeds have a high market value ranging from 200–400 rupees per kg across various states in South India (Kumar et al. 2010). Tribal people use the fruits, flowers and pseudostem as a vegetable in South India. *Ensete superbum* is also used as an ornamental because of its large conical pseudostem and leaf arrangement. The flower juice is used to treat dysentery and excess bleeding during menstruation in young girls (Padal et al. 2010).

Morphological variation: This taxon shows much variation in the size of vegetative as well as reproductive parts. At high altitudes the bracts sometimes develop a slightly greenish colour, and the number of flowers and fruits in a bunch can vary greatly. The number of stamens per flower can also vary from three, four and six.

Notes: *Musa superba* was first listed in Roxburgh's (1814) *Hortus Bengalensis* and a detailed description appeared in *Plants of the Coast of Coromandel* (Roxburgh 1819). Horaninow (1862) followed Roxburgh and failed to place *M. superba* under *Ensete* in spite of its close resemblance to the latter. Later, Cheesman (1947) correctly placed the species in *Ensete* when he reviewed and resurrected the genus.

Recently Luu et al. (2012) described a species, *E. lecongkietii*, from close to human habitation in Vietnam, based mainly on differences in size and number of anthers in male flowers compared with those of *E. superbum*. During this study we became convinced that this taxon is the same as *E. superbum* and we have treated it as conspecific. *Ensete superbum* is a species with a wide range of variation in size, number of fruits, flowers, and stamens in male flowers. *Ensete superbum* was earlier considered an endemic to the Western Ghats, India. There are some reports of it growing near temples and houses in Myanmar and Thailand. These plant might be disjunct populations or escapees from gardens since they were reported from populated areas.

IUCN status: Under IUCN criteria *Ensete superbum* should be listed under the category of Least Concern (IUCN 2011). It is very common in Western Ghats, and is also distributed throughout Peninsular India.

Additional specimens examined: INDIA, ANDHRA PRADESH: East Godavari Dist., Errakonda, 400 m alt., 05 Jul 1965, G.V. Subba Rao s.n. (MH); Vishakapatnam Dist., Arakku, Adapavalasa block, 950 m alt., 20 May 1964, G.V. Subba Rao s.n. (MH). GUJARAT: Waghai, Dangi Forest, 12 Feb 1956, N.A. Irani 1716B (BLAT). KERALA: Palghat Dist., Mukkali forest, 300 m alt., 25 Aug 1966, E. Vajravelu 27823 (MH); Thrissur Dist., Sholayar, 725 m alt., 21 Mar 1989, N. Sasidharan 5357 (KFRI); Thrissur Dist., on the way to Sholayar from Athirapilly, 10 Jul 2012, A. Joe & Sreejith 130888 (CALI); Malappuram Dist., Villunniyal (cultivated), 16 Nov 2010, A. Joe & Sreejith 116101 (CALI); Malappuram Dist., Calicut University Botanical Garden (Cultivated), Near West Gate, 15 Sep 2012, A. Joe & M. Sabu 130896 (CALI); Malappuram Dist., Calicut University Botanical Garden (cultivated), Near West Gate, 18 Jul 2013, A. Joe & M. Sabu 121683 (CALI); Malappuram Dist., Calicut University Botanical Garden (Cultivated), Ginger Zone, 28 Apr 2013, A. Joe & M. Sabu 130778 (CALI). MAHARASHTRA: Khandala, Behrams Plateau, 18 Jul 1953, H. Santapau 15698 (BLAT); Purandar Path, above camp, 08 Oct 1950, H. Santapau 11390 (BLAT); Sindhudurgh Dist., Sawanthawadi, 19 Aug 2014, Kabeer & K.M. Manudev 143027 (CALI). TAMIL NADU: Coimbatore Dist., Poonachi Ghat, Oct 1900, Dr. C.A. Barber s.n. (MH); Coimbatore Dist., 17 Mar 1931, V. Narayanaswami 5434 (MH). WEST BENGAL: Calcutta Botanical Garden (cultivated), s.c., s.n. (CAL). UNKNOWN LOCALITY: 1880, R.A. Beddome s.n. (MH); Museum compound, 1881, G. Biddie s.n. (MH).



Fig. 4. Lectotype of *Ensete superbum*: Roxburgh s.n. (K). Image courtesy of the Board of Trustees of Royal Botanic Garden, Kew.

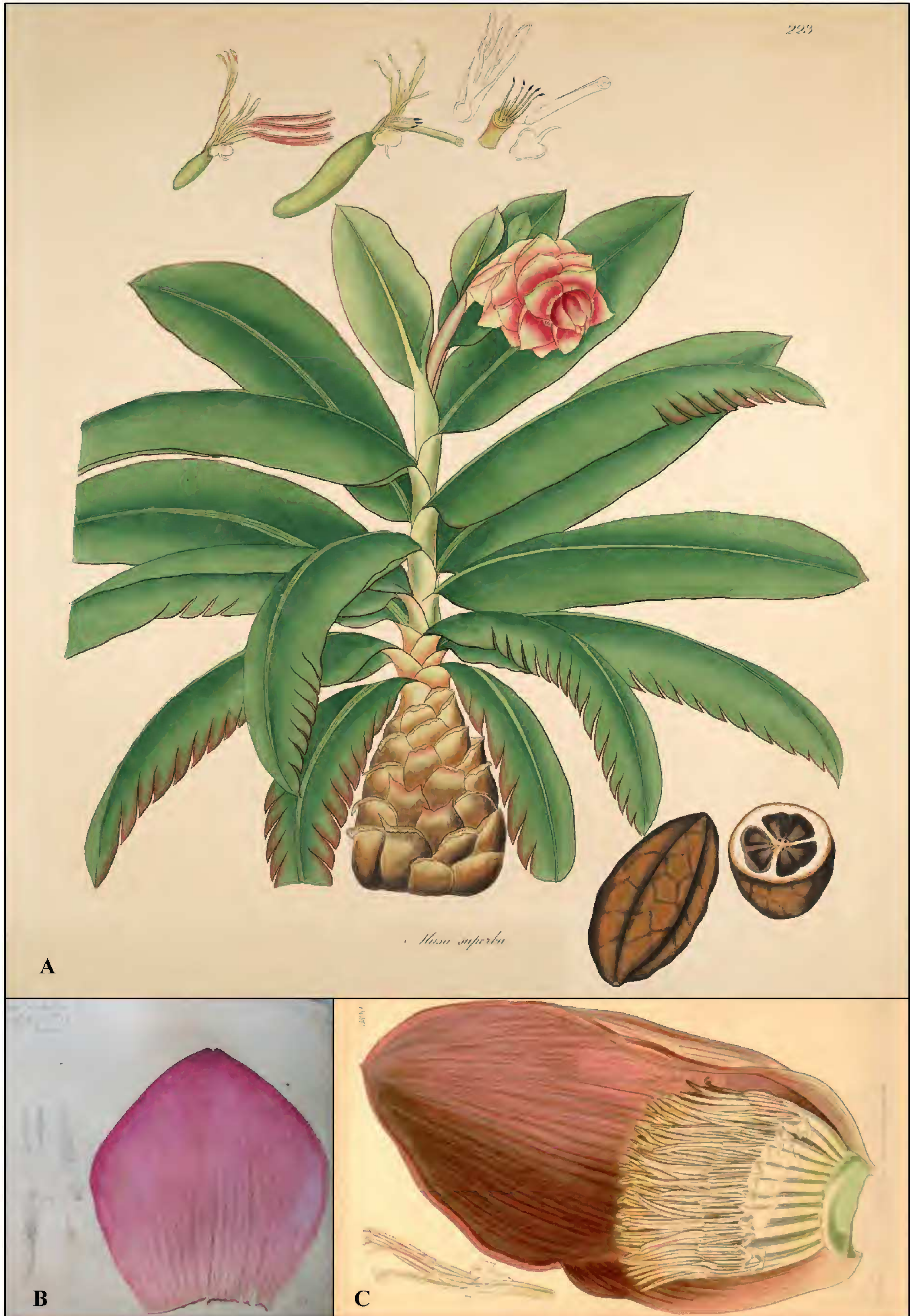


Fig. 5. a, original painting of *Ensete superbum* from Roxb., Pl. Coromandel 3: t. 223(1819); b, painting found along with specimens at CAL; c, painting in Curtis' Bot. Mag. 67: t. 3850 (1841).



Fig. 6. *Ensete glaucum*: a–c, variations across inflorescences; d, partially cylindrical pseudostem after removal of outer sheath for food (from Mizoram); e, seedling growing epiphytically in tree canopy; f, seedling; g–h, female flowers with 3 and 1 fertile stamens respectively; *Ensete superbum*: i, bract containing male flowers with 3 fertile stamens; j, male flower with 3 stamens; k, variation in fruits size and shape; l, undeveloped fruits; m–s, form variation across inflorescences and infructescences. Photos by Alfred Joe.

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